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ON THE HABITS AND AFFINITIES OF THE NEW
AUSTRALIAN MAMMAL, *NOTORYCTES TYPHLOPS*.

By E. D. COPE.

The description of this remarkable mammal by Professor Stirling, of the University of Adelaide, has appeared in the *Transactions of the Royal Society of South Australia*, 1891 (July), p. 154. The announcement of the discovery of this supposed new marsupial by Prof. Stirling in the English journals during the past season has excited much interest, and the full description now given will be carefully read. My own reading has led me to make certain reflections on the characters and affinities of the animal, which are herewith given. But I first copy the following account of its

HABITS

from Professor Stirling's paper:

"It appears that the first specimen was captured by Mr. Wm. Coulthard, manager of the Frew River Station and other Northern runs belonging to the Willowie Pastoral Company. Attracted by some peculiar tracks on reaching his camp one evening on the Finke River, while traversing the Idracowra Station with cattle, he followed them up and found the animal lying under a tussock of spinifex, or porcupine grass (*Triodia irritans*). Though he is an old bush hand, with all the watchful alertness and powers of observation usually acquired by those who live lives of difficulty and danger, this was the first and only specimen of the animal he ever saw. As previously stated, this found its way to the museum through the agency of Messrs. Benham and Molineaux. The three subsequently received shortly afterwards, as well as the last lot recently secured by Mr. Bishop during our journey through the country, were also found on the Idracowra Station. This is a large cattle-run, comprising several hundred square miles of country in the Southern part of the Northern Territory of South Aus-

tralia, which lies immediately to the West of the telegraph line between the Charlotte Waters and Alice Springs Stations. The great dry water-course of the Finke River, which runs from N. W. to S. E., bounds the run for some eighty miles on the North and North East. Its distance from Adelaide is, roughly speaking, a thousand miles. Flats and sandhills of red sand, more or less well covered with spinifex and acacias, constitute a large portion of the country, and the rainfall is inconsiderable. Curiously enough, all the specimens hitherto received by me have been found within a circumscribed area, four miles from the Idracowra Head Station, which is situated on the Finke water-course itself, and almost invariably among the sandhills. I have it, however, on very fair authority, that the animal has been seen on the Undoolya Station, which lies immediately South of the McDonnell Ranges, and that one also was found drowned after heavy rain at Tempe Downs, a station situated about 120 miles W. S. W. of Alice Springs. These points will sufficiently define its range, so far as is known at present. They do not appear to be very numerous. Very few of the white men in the district had ever seen it, even though constantly traveling, and not many of the natives whom I came across recognized the well-executed colored drawing I carried with me. It must be remembered, however, that I did not pass through the exact spot which so far appears to be its focus of distribution. Nor did a very considerable reward which I offered cause any specimens to be forthcoming between the first lot received, over two years ago, and that recently secured during my transcontinental trip. With few exceptions the animals have been captured by the aboriginals, who, with their phenomenal powers of tracking, follow up their traces until they are caught. For this reason they can only be found with certainty after rain, which sets the surface of the sand and enables it to retain tracks that would be immediately obliterated when it is dry and loose. Nor are they found except during warm weather. So that the short period of semi-tropical summer rains appears to be the favorable period for their capture. For this suitable combination of wet and warmth, Mr. Bishop had to wait three months

before he was able to get them, and in all cases they were found during the day time. Perpetual burrowing seems to be the characteristic feature of its life. Both Mr. Bishop and Mr. Benham, who have seen the animal in its native state, report that emerging from the sand it travels on the surface for a few feet, at a slowish pace, with a peculiar sinuous motion, the belly much flattened against the ground while it rests on the outside of its fore-paws, which are thus doubled in under it. It leaves behind it a peculiar sinuous triple track, the outer impressions more or less interrupted, being caused by the feet, and the central continuous line by the tail, which seems to be pressed down in the rear. Constantly on the look-out for its tracks, I was often deceived by those of numerous lizards, which are somewhat similar in these respects. It enters the sand obliquely and travels underground either for a few feet or for many yards, not apparently reaching a depth of more than two or three inches, for whilst underground its progress can often be detected by a slight cracking or moving of the surface over its position. In penetrating the soil, free use as a borer is made of the conical snout with its horny protecting shield, and the powerful scoop-like fore-claws are also early brought into play. As it disappears from sight, the hind limbs as well are used to throw the soil backward, which falls in again behind it as it goes, so that no permanent tunnel is left to mark its course. Again emerging at some distance, it travels for a few feet upon the surface, and then descends as before. I hear nothing of its making or occupying at any time permanent burrows. Both my informants lay great stress on the phenomenal rapidity with which it can burrow, as observed both in a state of nature and in captivity. In some notes sent me by Mr. Benham the following statement appears: 'Almost any of the men here (Idracowra) can tell you how one got away from me in the loose sand. I brought it home alive and began talking about how fast it could burrow, so Mr. Stokes wanted to see it. We took a spade and loosened the top soil near the house, and put it down. I kept my hand close to it until it was nearly out of sight, and then started scratching after it,

but it was too quick; so I took a shovel and began to dig after it, but could not get him.

“ ‘One of the men then came with another shovel, and also a lubra (aboriginal female) who scratched, but the three of us failed to get him.’ Making all allowances for possible misdirected energies in this experiment, there is no doubt but that their burrowing powers are remarkable. Mr. Bishop, who knew of my approach, made great efforts to keep alive for me some of those he had captured, and placed them for safe keeping in buckets of sand, but in spite of all care and attention one only lived as long as four days. Night and day the sound of their ceaseless burrowing was to be heard. Acting on my advice, previously given, in consequence of an examination of the contents of the intestines of one of the earlier specimens, he supplied them with ants as food, but they ate none. They did, however, eat one ‘witchety,’ the native name of large white grubs, much relished by the blacks as an article of food, which are the larval forms of certain Longicorn beetles and Lepidoptera, and Mr. Benham informed me that one of his ate a piece of bread on one occasion, but it only lived a day. They thus appear to stand captivity very badly. On being handled they make no attempt to bite. No black fellow that I questioned had even seen the young, nor did they know any thing whatever of any nests or breeding places used by them. Their native name is ‘oor-quamata,’ the terminal ‘r’ of the first syllable being much rolled so as almost to convey the sound of an interpolated short ‘i’ between the ‘r’ and the ‘q’; the accentuated syllable is strongly marked, the vowels having the same value as in ‘quarrel.’ Mr. Benham states that the natives have a superstitious dread of them, and applied to one the term ‘kudoicka’ which they translate as ‘devil-devil;’ but I could not get this confirmed by any of the blacks I saw. In fact the natives seem to know very little about them, and could give me no information whatever as to what their food was, or whether they got it above or under ground. With the material at my disposal I should be able definitely to settle this point, and indeed, in one of my first specimens, I did most certainly find the remains of ants and

some other insect debris in what remained of the intestines; but as the Editor of these Transactions urgently calls for the completion of this paper, I am reluctantly obliged to postpone to a future issue the result of further investigation on this and on other points." (Trans. Roy. Soc. South Australia, vol. xiv, Pt. I, 1891. p. 155).

AFFINITIES.

The most superficial observer will be at once struck with the remarkable resemblance which evidently subsists between the genus *Notoryctes* and the *Chrysochlorid* *Insectivora* of South Africa. The question then presents itself, is this a case of adaptive resemblance, or is it an example of true affinity? The question to be decided early in the investigation is whether *Notoryctes* is truly a marsupial.

The evidence furnished by Prof. Stirling that this animal is marsupial, consists of the following characters. First; it has a posteriorly opening marsupial pouch. Second; it has two very small osseous nodules in the tendon of the external oblique muscles, close to their insertion on the anterior border of the pubic symphysis (p. 178). They are scarcely visible without a lens, and are consequently liable to be overlooked. Third; the angle of the lower jaw is inflected. On these characters it may be remarked; First; that the pouch contains no mammæ as in *Marsupialia*, indicating that the early parturition of that order does not exist. Second; that a fibro-cartilage connects the external oblique muscle with the pubis in *Canis*, which Huxley, (*Anatomy of Vert. Animals*, p. 355) says "appears to represent the marsupial bone or cartilage of the marsupials." Third; that the inflection of the angle of the mandible is not greater, (to judge from Prof. Stirling's figures), than that seen in some *Glires* (*Haplodontia*) and *Insectivora*. In fact, this region is much like that seen in the species of *Chrysochloris*, where the angle is produced and incurved.

In opposition to the view that *Notoryctes* is a marsupial may be cited the two objections just made to the first and second of the characters adduced by Stirling, which might however be overcome, if stronger marsupial characters could

be found in the brain and reproductive system. The brain has not been examined, but the external form of the skull indicates characters like those of *Chrysochloris*, including larger hemispheres than are usual in marsupials. As to the reproductive system, the penis is single, indicating an undivided vagina in the female, a character non-marsupial, or present only in a highly specialized family of the order. The penis is cloacal as it is in *Chrysochloris*, as described by Dobson (*Monograph of the Insectivora* p. 125). Returning to the skeleton, we have other Insectivorous characters, which are non-marsupial. First; the imperforate palate; Second; the presence of a patella; Third; the incisor teeth, which are neither diprotodont, nor polyprotodont, but in number 3, normal in the placental Mammalia.

If we adopt the view that this genus is placental, we have the following additional points of resemblance to the *Chrysochloridæ*. First, the general shape and structure of the skull. Second, the shape of the scapula, where the inferior (posterior) spinous ridge represents the edge of the thickened border in *Chrysochloris*. Third, the presence of a heavy metacromion. Fourth, the slenderness of the clavicle. Fifth, the shape of the humerus, especially distally, where however the entepicondylar foramen is closed, while it is open in *Chrysochloris* (Dobson). Sixth, the shapes of the ulna and radius are much like those in *Chrysochloris*. Seventh, even the form and character of the anterior foot, where the resemblance is great, although obvious differences exist. Eighth, the general shape of the pelvis is similar, especially the horizontal position, with minute obturator foramen. The presence of a symphysis pubis, and a posterior articulation of the ischium with the sacrum are important differences. The symphysis exists however in various Insectivora and the ischiosacral articulation is present in many Edentata. There is not much resemblance in the forms of the tibia and fibula, but these two elements are distinct from each other in both forms. Ninth, the posterior foot resembles considerably that of *Chrysochloris*, with manifest differences; and is similarly related to the anterior foot in proportions, and in the number of its digits, five to four, both genera. Tenth, the dentition.

Here the characters are remarkably like those of *Chrysochloris* both in the number and detailed structure of the teeth. The anterior incisors are long in the latter, and in *Notoryctes* there is no heel to the inferior true molars, thus resembling the true genus *Chrysochloris*.¹

Such an aggregate of resemblances to the *Chrysochloridæ* signifies, it appears to me, zoological affinity. Whether *Notoryctes* will ultimately be found to enter the *Marsupialia* or not, it must be a descendant out of the same stock as that which gave origin to the *Chrysochloridæ*. But I suspect that the brain, female generative organs, and foetal characters will turn out to resemble those of *Chrysochloris*, as do its other characters, and in that case *Notoryctes* will enter the *Insectivora*. In this order it will form a special family, *Notoryctidæ*, characterized by the presence of a symphysis pubis; the coossification of the posterior part of the ischium with the sacrum, and perhaps by the coossification of the cervical vertebræ. Perhaps there should be added to these characters, the fusion of the sacral metapophysis into a continuous roof, and the ossification and fusion with the first rib of its hæmapophysis.

The tritubercular molars, the large caudal intecentra, the cloacal penis, show *Notoryctes* to be a primitive type. As to resemblances to *Monotremata*, such as have been suggested by a recent author, none exist. On the contrary, the *Notoryctidæ* realize a desideration to mammalian phylogeny, viz: a form which connects the marsupial with the placental mammalia, although it is a specialized representative of this type. That the insectivora are the connectant forms among placentals has been long suspected and, that the connection is polyphyletic is suggested by *Notoryctes*, since the *Creodonta* are also candidates for this position, from the resemblance of some them to the *Dasy-*

¹ There are three genera of *Chrysochloridæ*, which are distinguished by the following dental characters, already pointed out by authors (See Dobson l. c. p. 109).

Teeth 40; lower molars without heel; *Chrysochloris* Cuv.

Teeth 40; lower molars with heel; *Bematiscus* Cope.

Teeth 36; lower molars with heel; *Amblysomus* Pom.

Chrysochloris includes only the *C. aurea*; *Bematiscus* includes *C. villosa* and *C. trevelyanii*; and *Amblysomus* the *C. rutilans* and *C. obtusirostris*. All are South African.

uridæ. The structure of the pelvis approximates that of a number of the Edentata, as do apparently the inferior incisor teeth. The origin of the latter order has yet to be discovered.

The existence of a South African type of placental mammal in Australia need not greatly surprise us, since the fresh water fish *Gonorhynchus greyi* is common to both countries, and the ratite birds and pleurodire tortoises are found in both.

EXPLANATION OF PLATES.

Copied from Prof. Stirling's Memoir in the Transactions of the Linnean Society of South Australia.

PLATE IX.

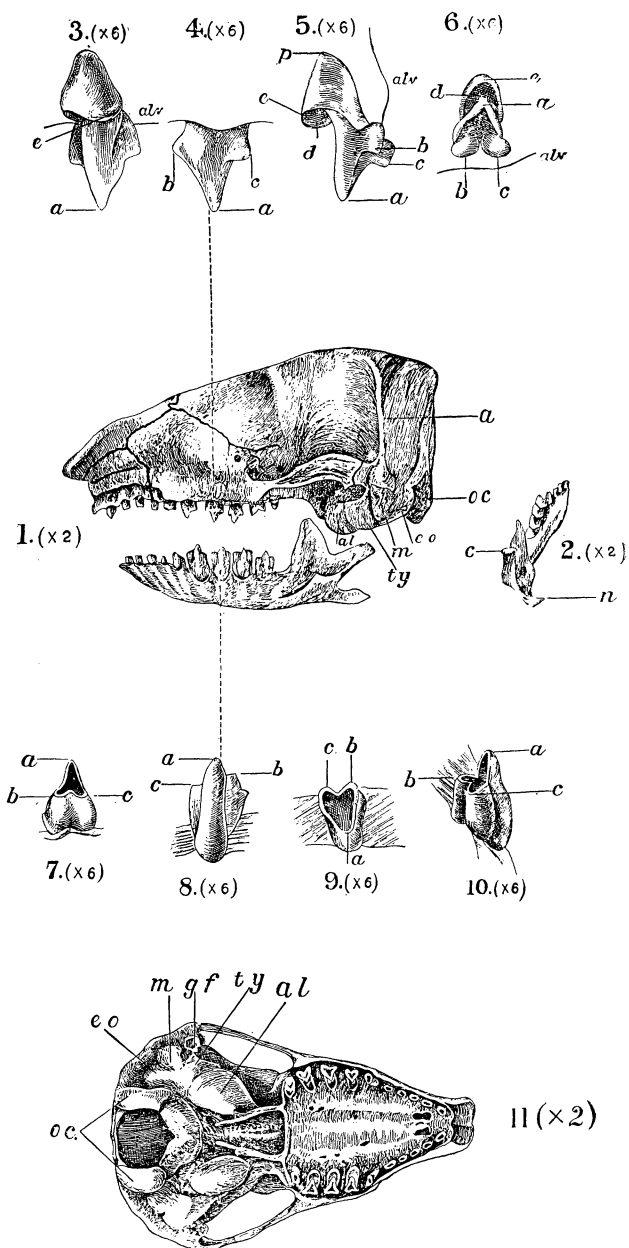
Notoryctes typhlops Stirling, natural size, side view. Fig. 2, muzzle from front.

PLATE X.

Notoryctes typhlops, skull and dentition enlarged. Fig. 1, skull side view. Fig. 2, lower jaw from behind. Figs. 3-6, superior molar from within, without, from front, and from below. Figs. 7-10, inferior molar, from within, without, above, and obliquely. Fig. 11, skull from below.



PLATE X.



Notoryctes typhlops.